Appendix A

Instructions for Experiment 2

This is an experiment in decision-making. If you follow the instructions and make good decisions, you can earn a substantial amount of money, which will be paid to you at the end of the session.

The experiment consists of 20 identical decision rounds. At the beginning of the experiment you will be randomly matched with two other subjects participating in the experiment. One subject in your group will be assigned to be player GREEN; the other subject will be player RED and the third subject – player BLUE. At the top of the screen you will be told whether you are acting as player GREEN, RED or BLUE. Subjects in your group and the roles assigned to them will not change for the whole experiment. The identity of the subjects in your group will never be revealed to you and subjects in your group will never know your identity.

The currency in this experiment is called tokens. All payoffs are denominated in this currency. The total amount of tokens you earn in the experiment will be converted into US dollars and paid to you at the end of the experiment. For RED player the conversion rate is 7 tokens = \$1, for BLUE player the conversion rate is 15 tokens = \$1, for GREEN player the conversion rate is 22 tokens = \$1.

Your decision in each round.

Each round of this experiment has the following flow of events:

- At the beginning of each round the computer will choose a number between 0 and 9 at random with equal probability. This means that the probability that 1.5 is chosen is equal to the probability that 6.25 is chosen, which is equal to the probability that 7.7 is chosen, etc... We will call the random number chosen x.
- Number x chosen by the computer is observed only by the player GREEN. Players BLUE and RED don't get to see the value of x drawn.
- After GREEN observes the value of x, he makes an announcement about the value of x, which is observed by both RED and BLUE players. The announcement can be any number between 0 and 9.
- After the announcement is made, RED and BLUE each chooses one of two available options labeled A or B. Each subject (RED or BLUE) in the group will make his/her choice without knowing what the other subject chooses.
- The payoffs of all players in the group depend on the actual value of x chosen by the computer, and the choices made by players RED and BLUE. We will describe those in detail in

the next section.

Payoffs

The payoff of each subject in a particular round depends on the number x chosen by the computer, and the options chosen by the RED and BLUE players. The table below summarizes the payoffs of players RED and BLUE.

The payoff of player GREEN is the sum of the payoffs of RED and BLUE:

		RED choice	
		option A	option B
BLUE choice	option A	$2x+5, x+5$	$2.16x+10, 5$
	option B	$x+10, 1.5x$	$0.16x+20, 10-0.5x$

Here is how to read this payoff table.

The table has four cells or boxes each determined by the choices made by BLUE and RED. For example, if BLUE and RED both choose option A, then payoffs are given by the cell in the upper left hand corner of the table. In this cell there are two payoffs, one on the left and one on the right. The first payoff, $(2 * x + 5)$, is the payoff to BLUE, while the second payoff, $(x + 5)$, is the payoff to RED (this is also indicated by the color of the payoff). The payoff of player GREEN is the sum of the payoffs of BLUE and RED: $2 * x + 5 + x + 5 = 3 * x + 10$. If BLUE chose option A and RED chose B, the relevant cell would be the upper right hand corner cell with payoff of $2.16 * x + 10$ to BLUE, 5 to RED and $2.16 * x + 15$ for GREEN.

The payoffs of all players depend on the x that was chosen by the computer. For example, say that player BLUE chose option A, player RED chose option A and the computer randomly chose $x = 5.5$. Then relevant payoffs are in the upper left hand corner of the matrix: BLUE gets $2 * 5.5 + 5 = 16$ tokens, RED gets $5.5 + 5 = 10.5$ tokens, and GREEN gets $16 + 10.5 = 26.5$ tokens. If, on the other hand, both BLUE and RED were to choose option B, then BLUE would get $0.16 * 5.5 + 20 = 20.88$ tokens, RED would get $10 - 0.5 * 5.5 = 7.25$ tokens and GREEN would get $20.88 + 7.25 = 28.13$ tokens. In other words, player GREEN gets higher payoff when x = 5.5 and both BLUE and RED players choose option B, than when they both choose option A.

Let's do one more example: say computer randomly chose x = 8 and both players BLUE and RED chose option A, then the relevant payoffs are in the upper left cell: BLUE will get $2 * 8 + 5 = 21$ tokens, RED will get $8 + 5 = 13$ tokens and GREEN will get $21 + 13 = 34$ tokens. If, instead, BLUE

were to choose option B, the relevant payoffs are in the bottom left cell: BLUE gets $8 + 10 = 18$ tokens, RED gets $1.5 * 8 = 12$ tokens and GREEN gets $18 + 12 = 30$ tokens. That is, GREEN gets a higher payoff when $x = 8$ and both BLUE and RED players choose option A, then when BLUE chooses B and RED chooses A.

However, RED and BLUE will not know the exact value of x before you get to choose between option A and B. Instead, they will observe an announcement describing x, made by GREEN.

Player GREEN can make any announcement describing the value of x. Recall that GREEN observes the actual value of x drawn randomly by the computer. Also, recall that the payoff of GREEN equals the sum of the payoffs of RED and BLUE, which depend on the actual value of x chosen by the computer and options chosen by RED and BLUE.

What your screen looks like:

On the top of the screen you will see whether you are acting as player BLUE, RED or GREEN. All players in the group will also observe the payoff matrix described above.

Player GREEN will also observe the actual value of x that the computer chose at random and the payoff matrix with the actual value of x substituted in. Before player GREEN will be prompted to make an announcement describing x, he will be able to use the built-in calculator. This calculator works as follows: for each value of x GREEN enters, it shows the payoff matrix with this x substituted in. This is the matrix that will be shown to BLUE and RED players if GREEN will choose to announce this value of x. GREEN can try as many values of x as he/she wants. When GREEN ready to make an announcement, he should simply press the "confirm announcement" button. Recall that announced x should be a number between 0 and 9.

Here is how the screen will look for player GREEN:

[SCREEN SHOT FOR PLAYER GREEN]

After announcement is made, BLUE and RED both see the announcement and they also see the payoff matrix with announced x substituted in. RED and BLUE then choose between option A and B by clicking on the box A or B on the bottom of the screen and then "confirm" button.

Here is how the screen for players BLUE and RED looks like:

[SCREEN SHOT FOR PLAYERS BLUE AND RED]

After both RED and BLUE have made their choices about option A or B, the following information will be observed by all players:

1. actual value of x chosen by computer
2. announced value of x made by GREEN
3. payoff matrix with ACTUAL value of x substituted in
4. cell with relevant payoffs, determined by the choices made by RED and BLUE

Then you will proceed to the next round which will be identical to the round you just finished, except that at the beginning of the new round a new value of x will be chosen.

Payment

The number of tokens you earn in this experiment will be converted to US dollars using the following conversion rates: If you are acting as player RED, the conversion rate is 7 tokens = \$1. If you are acting as player BLUE, the conversion rate is 15 tokens = \$1. If you are acting as player GREEN, the conversion rate is 22 tokens = \$1.

To summarize:

- Each round starts with the computer randomly choosing x between 0 and 9
- Player GREEN observes the actual value of x chosen by the computer
- Player GREEN makes an announcement describing the value of x
- Both RED and BLUE see the announcement, as well as the payoff matrix with announced x substituted in; then they have to choose between option A and B.
- After both RED and BLUE have made their choices, everyone gets to observe the actual value of x chosen by the computer, the announced value of x made by GREEN, the payoff matrix with the actual value of x substituted in and the relevant payoff cell determined by the choices made by RED and BLUE.
- The final payoffs of the subjects are determined by the payoff table described above. The payoffs of RED are indicated by the red color and the payoffs of BLUE are indicated by the color blue in the payoff matrix. The payoff of GREEN is equal to the sum of the payoffs of RED and BLUE.

Appendix B

Instructions for Experiment 3

This is an experiment in decision-making. If you follow the instructions and make good decisions, you can earn a substantial amount of money, which will be paid to you at the end of the session. The experiment in total consists of 4 parts, with20 identical decision rounds in each part. Before the start of each part you will be given the instructions for the following 20 decision rounds of the experiment.

The currency in this experiment is called tokens. All payoffs are denominated in this currency. Your payment in the experiment will consist of several parts: you will earn tokens for each part of the experiment, the total amount of which will be converted into US dollars using the rate 29 tokens = \$1. Payments for each part of the experiment are independent of each other and will be described to you in detail in the instructions. You will receive all the payments at the end of the experiment.

At the beginning of each part of the experiment you will be randomly matched with one other person participating in the experiment. One person in your pair will be assigned to be subject 1 and the other subject 2. You will stay paired with this subject for the 20 rounds of this part of the experiment. The identity of the subject you are paired with will never be revealed to you and the subject you are paired with will never know your identity.

At the top of the screen you will be told whether you are acting as subject 1 or subject 2. If you were assigned to be subject 1 at the beginning of one part of the experiment you will remain subject 1 for the whole part of 20 rounds. After the part is over you will be re-matched randomly with another subject participating in the experiment. Again, one of the subjects in the pair will be assigned to be subject 1 and the other subject 2, and so on.

Instructions for the first part of the experiment.

Your decision in each round.
At the beginning of each round the computer will choose a number between 0.2 and 6.2 at random with equal probability. This means that the probability that 1.5 is chosen is equal to the probability that 4.25 is chosen, which is equal to the probability that 2.7 is chosen, etc... We will call the random number chosen x.

Your task in each round is to choose an option labeled A or B. The subject you are paired with also chooses between option A and option B. Each subject in the pair will make his/her choice without knowing what the other subject chooses.

Payoffs.
The payoff of each subject in a particular round depends on the number x chosen by the computer, and the options chosen by you and your opponent. The table below summarizes the payoffs of both subjects:

		subject 2 choice	
		option A	option B
subject 1 choice	option A	$2x+3, x+3$	$2x+8, 3$
	option B	$x+6, 1.5x$	$1.75x+8.75, 6-0.5x$

Here is how to read this payoff table. The table has four cells or boxes each determined by the choices made by subjects 1 and 2. For example, if Subject 1 and Subject 2 both choose option A, then the payoffs for each subject are given by the cell in the upper left hand corner of the table. In this cell there are two payoffs, one on the left and one on the right. The first payoff, $(2 \times x + 3)$, is the payoff to Subject 1 while the second payoff, $(x + 3)$, is the payoff to Subject 2. If Subject 1 chose option A and Subject 2 chose B, the relevant cell would be the upper right hand corner cell with payoffs to Subject 1 of $2 \times x + 8$ and payoffs to Subjects 2 of 3.

Note that your payoff depends on the x that was chosen by the computer. For example, say you were assigned to be Subject 1 and chose option A. Say, also, that the subject you are paired with chose option B and the computer randomly chose $x = 3$. Then you will get the payoff in the upper right hand corner of the matrix, $2 \times 3 + 8 = 14$ tokens, while your pair member would get 3 tokens. If, on the other hand, you were to choose option B, while the subject you are paired with chose option A and the computer picked $x = 1$, then you would get $1 + 6 = 7$ tokens and your pair member would get $1.5 \times 1 = 1.5$ tokens.

Before you and the person you are paired with make the choice, you will both observe the number x that was picked by the computer. Also you will be shown the relevant payoff table with number x being substituted in the original payoff matrix described above. Then you will choose one of two options: A or B. You will finalize your choice by clicking the "Submit" button.

Information Feedback
After both you and the subject you are paired with have made your choices you will get to observe the actions taken by you and your pair member, and both of your payoffs. You will then proceed to the next round which will be identical to the round you just finished except that at the beginning of the new round a new value of x will be chosen and the associated payoff table shown to you. The x chosen for any given round will be independent of that chosen in any previous round. In other words, it will again be a number drawn with equal likelihood from the interval 0.2 to 6.2.

Payment for the first part of the experiment

To determine your payment for the first part of the experiment we will sum up the number of tokens you earned in each of 20 rounds. This number of tokens will become part of the total number of tokens you will earn in the experiment which will be converted into US dollars and paid to you at the end of the experiment.

To summarize:

- each round starts with the computer randomly choosing a number x between 0.2 and 6.2, and both you and the subject you are paired with will observe the value of x as well as the payoff matrix with number x being substituted in it;
- each subject in the pair, after observing the value of x and its associated payoff table, then chooses between option A or B
- the final payoffs of the subjects are determined by the payoff table described above (you will see the payoff table on the screen all the time)

Instructions for the second part of the experiment.

At the beginning of this part of the experiment you will be randomly re-matched with one other participant in the experiment. One of the subjects in the pair will be assigned to be subject 1, the other subject 2. You will stay paired with this subject for the 20 rounds of this part of the experiment. The identity of the subject you are paired with will never be revealed to you and the subject you are paired with will never know your identity.

Your decision in each round

In this part of the experiment everything stays the same as in part 1 except for one thing: the situation you are in is made more complex by the fact that you will not know the exact value of x before you get to choose between option A and B. Instead, you and the subject you are paired with will hear the announcement describing x.

This announcement will be made as follows: before the start of this part of the experiment, the computer will divide the interval, $[0.2, 6.2]$ from which number x is picked into 2 pieces or sub-intervals. The computer will attach a word to each piece which will be announced to both subjects before you are asked to make your choice of option. For example, say that the interval of possible values of x was divided in the following way: all numbers from 0.2 to 3.3 are in the group called "low", whereas all numbers from 3.3 to 6.2 are in the group called "high". (In this example let us call 3.3 the "cutoff value" for x). Hence, given this partition, if at the beginning of the round, the computer randomly picks number x which is smaller than 3.3 (say 0.9 or 2.4), the computer

will announce that x is "low". If, on the other hand, x is greater than 3.3 (say 5.7 or 3.9) the computer will announce that x is "high". Both you and your pair member will get to observe that announcement before making your choices, but you will not be told the cutoff value.

Note that with this example, if x was announced to be low, then x can be any number between 0.2 and 3.3 with equal chance. That is, $x = 1.3$ and $x = 3$ are equally likely when the announcement is "x is low". The same is true for the announcement "x is high": any number between 3.3 and 6.2 has the exact same chance of being the actual value of x.

The actual cutoff value used will not necessarily be 3.3; that value was just used for exposition. In the experiment the computer has been programmed to choose its cutoff value in a manner to maximize the sum of the payoffs of the players.

Information Feedback

After the announcement is made and both subjects have made their choices about option A or B, the value of x picked by the computer will be shown to you and your pair member as well as the options the two of you have chosen. This will allow you to determine your payoff which will also be shown to you on your screen. So, at the end of each round you will get to observe the value of x, the word used to describe it, the actions taken by you and your pair member, and both of your payoffs. When a round is over you will then proceed to the next round which will be identical to the round you just finished except that at the beginning of the new round a new value of x will be chosen and a new announcement about its value will be made. The cutoff value used will be the same for all 20 rounds in this part.

Finally, after every 5 rounds we are going to ask you 2 questions:

- what you think the cutoff value of the computer is, and
- what you think your pair member thinks the cutoff value used by the computer is.

This will be done as follows. On the separate screen that will appear after every 5 rounds you will be asked to choose where you think the cutoff point of the computer is. Say, you think that the computer announces "x is low"whenever x is smaller than 3, otherwise (x is bigger than 3) the computer announces "x is high". Then you should choose number 3 as a cutoff value of the computer. Simply enter this number on the screen that will appear, press "Enter"and click the "Ok" button. Then you will observe the picture of the interval from 0.2 to 6.2 divided into 2 sub-intervals according to the cutoff point you just chose: the red colored interval will indicate the region for which you think the computer announces "x is low", and the blue colored region will indicate the region for which you think the computer announces "x is high". If you want to change your decision, you can change the cutoff value by clicking "Enter" and then click "Ok"again. Once you are happy with the partition you've chosen please click the "Submit"button.

The second question (what you think your pair member thinks the cutoff value used by the computer is) is done exactly in the same way: you need to choose the cutoff value you think your pair member chose. Note that you will not get to observe the partition chosen by other subjects and no other subject participating in the experiment will observe your choice of partition.

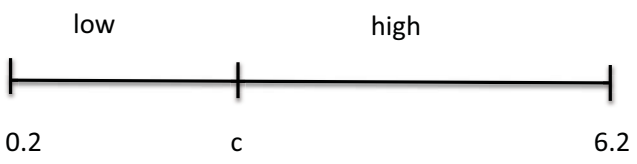
Payment for the second part of the experiment

The number of tokens you can earn in the second part of the experiment will consist of two parts: first, we will sum up the number of tokens you earned in each of 20 rounds. In addition, you will earn tokens for answering the two questions described above every five rounds. This will be done in the following way: say, you are answering the first question stated above which is "what cutoff value do you think the computer is using?" In other words, the question is asking you to state what you think the value of x is such that for any x below that value the computer will announce low and above which it will announce high. You will be prompted to answer this question. After you do we will compare your partition of the interval 0.2 to 6.2 to that actually used by the computer and pay you according to how close your partition, determined by your cutoff value, is to the partition used by the computer, determined by its cutoff value. We will do this according to the following formula:

$$\text{Payoff} = 12 - 0.33 \times (\text{your cutoff} \ - \ \text{computer's true cutoff})^2.$$

Note what this means. We will pay you a constant of 12 tokens but subtract from it the extent to which your cutoff value differed from that of the computer (the distance between them) squared times 0.33. So, if you guessed the computer's cutoff value correctly you will get 12 tokens (we will subtract nothing from you), but if you were completely wrong, i.e. if you said 6.2 while the computer was using a cutoff of 0.2 (or said 0.2 when the computer was using 6.2), you would receive 0 tokens.

Put differently, we are asking you to state a cutoff, call it the value c, which separates the region the computer (or the subject you are paired with) has associated with the word "low" and the word "high" as follows:



We have devised this scheme so that if you wanted to make the most amount of money in this part of the experiment, your best decision would be to state your truthful cutoff value, i.e. the one you truly believe the computer is using.

The exact same procedure will be used to elicit an answer from you to question 2, although here we will compare your answer not to the cutoff value used by the computer but rather to that used by your pair member when describing the cutoff point he thinks the computer is using. If you guessed this cutoff point correctly, then you will get 12 tokens, whereas if you were completely wrong you will get only 0 token. Again, given the payoff your best decision would be to state your truthful cutoff value, i.e. the one you truly believe the other subject is using.

You will repeat this procedure every five rounds.

The total number of tokens you receive in the second part of the experiment will be equal to the sum of your token payoffs in each round plus the sum of the tokens you received every five rounds when you tried to guess both the computer's and the other subject's cutoffs. This number of tokens will become part of the total number of tokens earned in the experiment which will be converted into US dollars and paid to you at the end of the experiment.

To summarize:

- each round starts with the computer randomly choosing a number x between 0.2 and 6.2 and, given the cutoff value used by the computer for the 20 rounds and the interval this number falls in, one of the two announcements, "x is low" or "x is high", is made and observed by both subjects in the pair
- each subject in the pair, after hearing the announcement about x but without observing the actual number x picked by the computer, then chooses between option A or B
- the final payoffs of the subjects are determined by the payoff table described above (you will see the payoff table on the screen all the time) and the actual value of x chosen in that round
- both subjects then observe the actual value of x and the payoffs for this round
- after every 5 rounds you will be asked to state what you think the cutoff value of the computer is, and what you think your pair member thinks the cutoff value used by the computer is

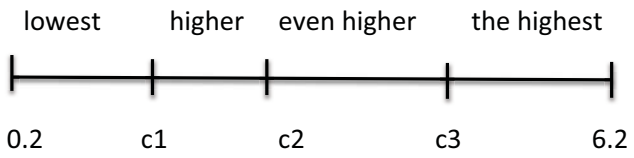
Instructions for the third part of the experiment.

At the beginning of this part of the experiment you will be randomly re-matched with one other participant in the experiment. One of the subjects in the pair will be assigned to be subject 1, the other subject 2. You will stay paired with this subject for the 20 rounds of this part of the experiment. The identity of the subject you are paired with will never be revealed to you and the subject you are paired with will never know your identity.

In this part of the experiment everything stays the same as in part 2 except for one feature. Before the start of this part of the experiment, the computer will divide the interval, $[0.2, 6.2]$ from which number x is picked into 4 (instead of 2) sub-intervals. To each of those sub-intervals a word describing this region will be attached and will stay the same for all 20 rounds of the third part. So, in each round you and the subject you are paired with will hear one of the following announcements: "x is lowest", "x is higher", "x is even higher" or "x is the highest". Everything else stays the same.

To summarize:

- each round starts with the computer randomly choosing a number x between 0.2 and 6.2 and, depending on the cutoff value used by the computer and the interval this number falls in, one of the four announcements, "x is lowest", "x is higher", "x is even higher" or "x is the highest", is made and observed by both subjects in the pair
- each subject in the pair, after hearing the announcement about x but without observing the actual number x picked by the computer, then chooses between option A or B
- the final payoffs of the subject are determined by the payoff table described above (you will see the payoff table on the screen all the time)
- both subjects then observe the actual value of x and the payoffs for this round
- after every 5 rounds you will be asked to state what you think the partition the computer uses is, and what you think your pair member thinks the partition the computer uses is. Your payoffs here will be identical to those described in part two of the experiment except that instead of stating one cutoff you will need to state three: one cutoff separating the "lowest"region from the "higher"region, one separating the "higher"region from the "even higher"region, and one separating the "even higher"region from the "highest" region. In other words, we are asking you to choose three numbers c_1, c_2, c_3 such that the following is true:



As in the previous part of the experiment, we will pay you for your guess as follows: let c_1^*, c_2^*, c_3^* be the cutoffs of the computer (or your pair member's guess of the computer's cutoff) and let c_1, c_2, c_3 be your guess. Then your payoff from guessing will be determined in an identical manner as we did in part two except for the fact that in this part you will have three cutoff values instead of

one. More precisely, your payoff will be determined as follows:

$$\text{Payoff} = 18 - 0.16 \times (c_1^* - c_1)^2 - 0.16 \times (c_2^* - c_2)^2 - 0.16 \times (c_3^* - c_3)^2.$$

Again, we have devised this scheme so that if you wanted to make the most amount of money in this part of the experiment your best decision would be to state your truthful cutoff value, i.e. the one you truly believe the computer is using.

Your payment for this part of the experiment will consist of 2 parts as in the second part of the experiment: the number of tokens you received in each round will be summed up and in addition you will be rewarded for stating partitions (the same way it was done before).

Instructions for the fourth part of the experiment.

At the beginning of this part of the experiment you will be randomly re-matched with one other participant in the experiment. One of the subjects in the pair will be assigned to be subject 1, the other subject 2. You will stay paired with this subject for the 20 rounds of this part of the experiment. The identity of the subject you are paired with will never be revealed to you and the subject you are paired with will never know your identity.

In this part of the experiment everything stays the same as in part 3 except for one feature. Before the start of this part of the experiment, the computer will divide the interval, $[0.2, 6.2]$ into, again, 2 sub-intervals: $[0.2, 5]$ and $[5, 6.2]$. But instead of announcing the word associated with each sub-interval, you will observe the interval itself. That is, if x is below 5 then you will observe the announcement "x is between 0.2 and 5" and if x is above 5 you will observe the announcement "x is between 5 and 6.2". Both you and your pair member will get to observe that announcement before making your choices.

Note that if x was announced to be in the interval $[0.2, 5]$ then x can be any number between 0.2 and 5 with equal chance. That is, $x = 1.3$ and $x = 3$, etc., are equally likely when the announcement is "x is between 0.2 and 5". The same is true for the announcement "x is between 5 and 6.2": any number between 5 and 6.2 has the exact same chance of being the actual value of x. Everything else stays the same.

To summarize:

- each round starts with the computer randomly choosing a number x between 0.2 and 6.2 and the computer announcing the interval that x falls in depending on the cutoff value chosen by the computer at the beginning of this part. This announcement is observed by both subjects in the pair

- each subject in the pair, after hearing the announcement about x but without observing the actual number x picked by the computer, then chooses between option A or B
- the final payoffs of the subjects are determined by the payoff table described above (you will see the payoff table on the screen all the time)
- both subjects then observe the actual value of x and the payoffs for this round

Your payment for this part of the experiment will consist of the sum of the payoffs you receive in each of the 20 rounds in part 4.

Total payoffs in the Entire Experiment.
Your final payoffs from participating in all four parts of the experiment will be the sum of your token payoffs in each part converted to dollars at the rate of 29 tokens = \$1.